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ROGERS POND, MECOSTA COUNTY, MICHIGAN

Pacific Northwest Environmental Research Laboratory

Prepared for:

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Michigan Department of Natural Resources
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16. ABSTRACT
Annual total phosphorus and total nitrogen loadings to the lake were estimated and subdivded according to either point or non-point source origin. An assessment of the lake's trophic condition and limiting nutrient is also provided. All data collected by the U.S.E.P.A. National Eutrophication Survey during the one year study of the lake and its tributaries are included in the report.

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REPORT
ON
ROGERS POND
MECOSTA COUNTY
MICHIGAN
EPA REGION V
WORKING PAPER No. 208

WITH THE COOPERATION OF THE
MICHIGAN DEPARTMENT OF NATURAL RESOURCES
AND THE
MICHIGAN NATIONAL GUARD

MARCH, 1975

CONTENTS

	Page
Foreword	ii
List of Michigan Study Lakes	iv
Lake and Drainage Area Map	v
Sections	
I. Conclusions	1
II. Lake and Drainage Basin Characteristics	4
III. Lake Water Quality Summary	5
IV. Nutrient Loadings	8
V. Literature Reviewed	13
VI. Appendices	14

FOREWORD

The National Eutrophication Survey was initiated in 1972 in response to an Administration commitment to investigate the nationwide threat of accelerated eutrophication to fresh water lakes and reservoirs.

OBJECTIVES

The Survey was designed to develop, in conjunction with state environmental agencies, information on nutrient sources, concentrations, and impact on selected freshwater lakes as a basis for formulating comprehensive and coordinated national, regional, and state management practices relating to point-source discharge reduction and non-point source pollution abatement in lake watersheds.

ANALYTIC APPROACH

The mathematical and statistical procedures selected for the Survey's eutrophication analysis are based on related concepts that:

a. A generalized representation or model relating sources, concentrations, and impacts can be constructed.

b. By applying measurements of relevant parameters associated with lake degradation, the generalized model can be transformed into an operational representation of a lake, its drainage basin, and related nutrients.

c. With such a transformation, an assessment of the potential for eutrophication control can be made.

LAKE ANALYSIS

In this report, the first stage of evaluation of lake and watershed data collected from the study lake and its drainage basin is documented. The report is formatted to provide state environmental agencies with specific information for basin planning [§303(e)], water quality criteria/standards review [§303(c)], clean lakes [§314(a,b)], and water quality monitoring [§106 and §305(b)] activities mandated by the Federal Water Pollution Control Act Amendments of 1972.

Beyond the single lake analysis, broader based correlations between nutrient concentrations (and loading) and trophic condition are being made to advance the rationale and data base for refinement of nutrient water quality criteria for the Nation's fresh water lakes. Likewise, multivariate evaluations for the relationships between land use, nutrient export, and trophic condition, by lake class or use, are being developed to assist in the formulation of planning guidelines and policies by EPA and to augment plans implementation by the states.

ACKNOWLEDGMENT

The staff of the National Eutrophication Survey (Office of Research & Development, U. S. Environmental Protection Agency) expresses sincere appreciation to the Michigan Department of Natural Resources for professional involvement and to the Michigan National Guard for conducting the tributary sampling phase of the Survey.

A. Gene Gazlay, former Director, and David H. Jenkins, Acting Director, Michigan Department of Natural Resources; Carlos Fetterolf, Chief Environmental Scientist, Bureau of Water Management; and John Robinson, Chief, Dennis Tierney, Aquatic Biologist, and Albert Massey, Aquatic Biologist, Water Quality Appraisal Section, Bureau of Water Management, Department of Natural Resources, provided invaluable lake documentation and counsel during the course of the Survey. John Vogt, Chief of the Bureau of Environmental Health, Michigan Department of Public Health, and his staff were most helpful in identifying point sources and soliciting municipal participation in the Survey.

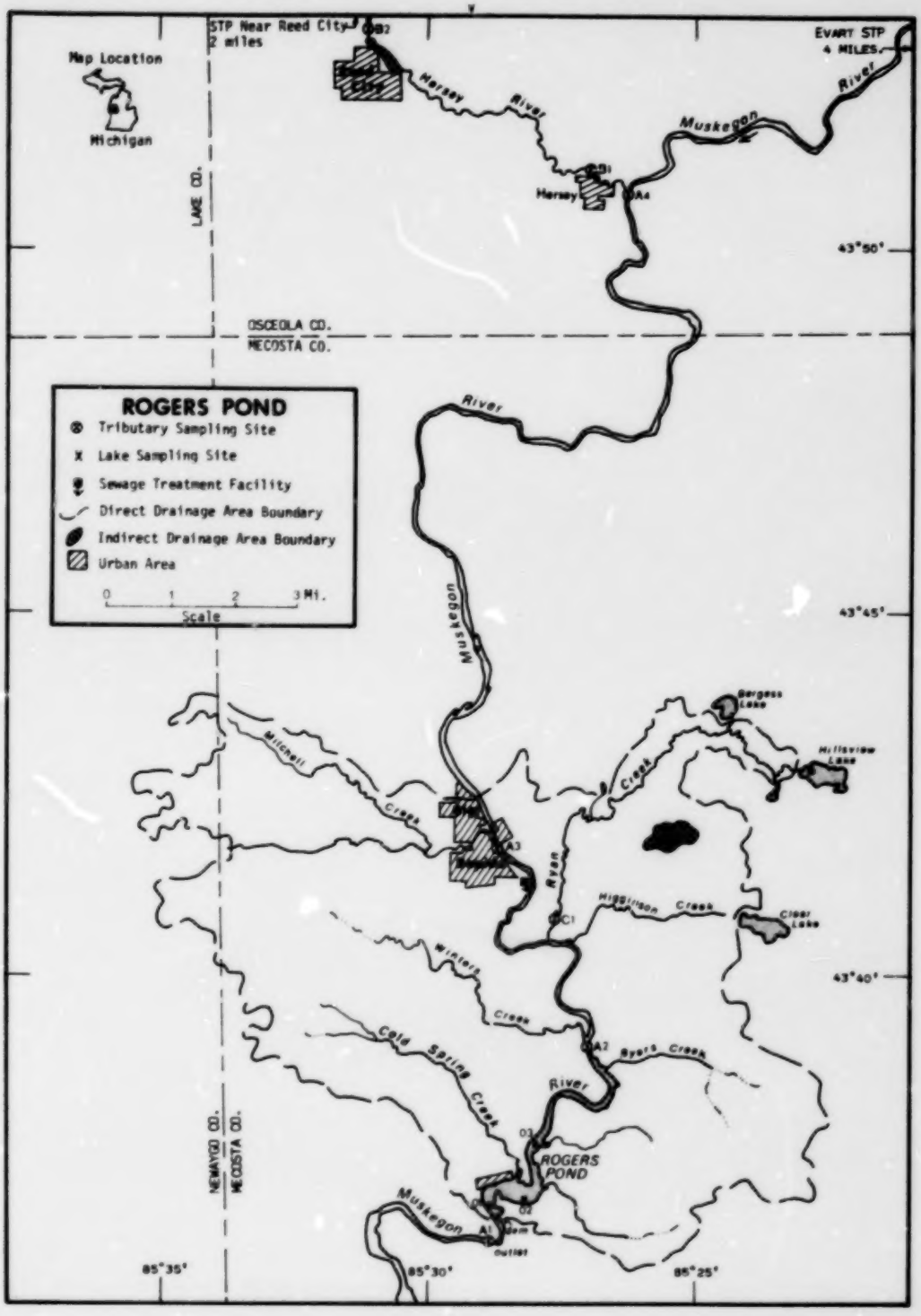
Major General Clarence A. Schnipke (Retired), then the Adjutant General of Michigan, and Project Officer Colonel Albert W. Lesky, who directed the volunteer efforts of the Michigan National Guardsmen, are also gratefully acknowledged for their assistance to the Survey.

NATIONAL EUTROPHICATION SURVEY

STUDY LAKES

STATE OF MICHIGAN

LAKE NAME	COUNTY
Allegan Res.	Allegan
Barton	Kalamazoo
Belleville	Wayne
Betsie	Benzie
Brighton	Livingston
Caro Res.	Tuscola
Charlevoix	Charlevoix
Chemung	Livingston
Constantine Res.	St. Joseph
Crystal	Montcalm
Deer	Marquette
Ford	Washtenaw
Fremont	Newago
Higgins	Roscommon
Holloway Res.	Genesee, Lapeer
Houghton	Roscommon
Jordon	Ionia, Barry
Kent	Oakland
Long	St. Joseph
Macatawa	Ottawa
Manistee	Manistee
Mona	Muskegon
Muskegon	Muskegon
Pentwater	Oceana
Pere Marquette	Mason
Portage	Houghton
Randall	Branch
Rogers Pond	Mecosta
Ross	Gladwin
St. Louis Res.	Gratiot
Sanford	Midland
Strawberry	Livingston
Thompson	Livingston
Thornapple	Barry
Union	Branch
White	Muskegon


STP Near Reed City
2 miles
EVART STP
4 MILES.
Map Location
Michigan
Hersey River
Muskegon River
Hersey
LAKE CO.
43°50'
OSCEOLA CO.
MECOSTA CO.
ROGERS POND
Tributary Sampling Site
Lake Sampling Site
Sewage Treatment Facility
Direct Drainage Area Boundary
Indirect Drainage Area Boundary
Urban Area
0 1 2 3 Mi.
Scale
Muskegon River
43°45'
Mitchell Creek
Ryan Creek
Hillsview Lake
Higgins Creek
Clear Lake
Winters Creek
43°40'
Cold Spring Creek
Byers Creek
River
ROGERS POND
NEWAYGO CO.
MECOSTA CO.
Muskegon
Outlet
85°35'
85°30'
85°25'

ROGERS POND

STORET NO. 2672

I. CONCLUSIONS

A. Trophic Condition:

Survey data show that Rogers Pond is eutrophic. Of the 35 Michigan lakes sampled in November when essentially all were well-mixed, eight had less mean total phosphorus, ten had less mean dissolved phosphorus, and four had less mean inorganic nitrogen (the relatively low concentrations of nutrients probably are due to a very short hydraulic retention time); of all 41 lakes sampled, 12 had less mean chlorophyll a, and 15 had greater mean Secchi disc transparency*.

Marked depression of dissolved oxygen occurred at about the 30-foot depth at station 1 in September, 1972.

B. Rate-Limiting Nutrient:

A significant loss of phosphorus occurred in the algal assay sample, and the results are not representative of conditions in the pond at the time the sample was taken. The pond data indicate nitrogen limitation at all sampling times.

C. Nutrient Controllability:

1. Point sources--During the sampling year, Rogers Pond received a total phosphorus load at a rate over five times the

* See Appendix A.

rate proposed by Vollenweider (in press) as "dangerous"; i.e., a eutrophic rate (see page 12). However, Vollenweider's model probably is not applicable to water bodies with short hydraulic retention times; and although the hydraulic retention time of Rogers Pond is not known, it is certain to be very short. For example, if the pond has a mean depth of 20 feet, the hydraulic retention time would be less than four days.

It is calculated that the communities of Big Rapids, Evart, and Reed City contributed about 16% of the total phosphorus load during the sampling year. Both Evart and Reed City have phosphorus removal facilities; however, during the sampling year, it appears the facilities were not very effective at either place (unless unknown industrial wastes, such as food-processing wastes, constitute a sizable portion of the load to each of the facilities). It is calculated that the effluent phosphorus load at Evart was equivalent to 3.8 lbs P/capita/yr and that at Reed City was equivalent to about 2.0 lbs P/capita/yr. On the other hand, the effluent contribution of Big Rapids was only 0.7 lbs P/capita/yr, and it appears that phosphorus removal facilities not known to us were operational there (Massey [1975] advises that 40% phosphorus removal at Big Rapids began in April, 1973).

While even complete removal of phosphorus at these communities would still leave a loading rate of about 21 $g/m^2/yr$, in view of the probable very short hydraulic retention time and the existing relatively low concentrations of nutrients in Rogers Pond, it is likely that a high degree of phosphorus control at the three point sources would at least reduce the incidence and severity of nuisance algal blooms, as well as provide additional protection for Lake Michigan.

2. Non-point sources--Although the mean annual non-point phosphorus export of the Muskegon River does not appear to be very high (see page 12), the N/P ratio indicates a possible point source beyond the 25-mile limit of the Survey.

In any case, the very high drainage area to lake area ratio of 2,318 to 1 will ensure a relatively high phosphorus load to Rogers Pond regardless of point sources, and it appears that all phosphorus inputs will have to be minimized to the greatest practicable degree if a marked improvement in the trophic condition of the pond is to be achieved.

II. LAKE AND DRAINAGE BASIN CHARACTERISTICS

A. Lake Morphometry:

1. Surface area: 511 acres†.
2. Mean depth: unknown
3. Maximum depth: >80 feet.
4. Volume: Unknown

B. Tributary and Outlet:
(See Appendix B for flow data)

1. Tributaries -

Name	Drainage area*	Mean flow*
Muskegon River	1,820.0 mi^2	1,365.6 cfs
Minor tributaries & immediate drainage -	34.2 mi^2	28.4 cfs
Totals	1,854.2 mi^2	1,394.0 cfs

2. Outlet -

Muskegon River	1,855.0 mi^2**	1,394.0 cfs

C. Precipitation***:

1. Year of sampling: 31.6 inches.
2. Mean annual: 32.0 inches.

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† Fetterolf, 1973.

* Drainage areas are accurate within ±5%; mean daily flows for 74% of the sampling sites are accurate within ±25% and the remaining sites up to ±40%; and mean monthly flows, normalized mean monthly flows, and mean annual flows are slightly more accurate than mean daily flows.

** Includes area of lake.

*** See Working Paper No. 1, "Survey Methods, 1972".

III. LAKE WATER QUALITY SUMMARY

Rogers Pond was sampled three times during the open-water season of 1972 by means of a pontoon-equipped Huey helicopter. Each time, samples for physical and chemical parameters were collected from three stations on the lake and from a number of depths at each station (see map, page v). During each visit, a single depth-integrated (15 feet or near bottom to surface) sample was composited from the stations for phytoplankton identification and enumeration; and during the second visit, a single five-gallon depth-integrated sample was composited for algal assays. Also each time, depth-integrated samples were collected from each of the stations for chlorophyll a analysis. The maximum depths sampled were 80 feet at station 1, 20 feet at station 2, and 42 feet at station 3.

The results obtained are presented in full in Appendix C, and the data for the fall sampling period, when the lake essentially was well-mixed, are summarized below. Note, however, the Secchi disc summary is based on all values.

For differences in the various parameters at the other sampling times, refer to Appendix C.

A. Physical and chemical characteristics:

Parameter	Minimum	Mean	Median	Maximum
		FALL VALUES (11/13/72)		
Temperature (Cent.)	6.0	7.7	8.5	8.5
Dissolved oxygen (mg/l)	9.8	10.0	10.0	10.2
Conductivity (μmhos)	325	347	350	365
pH (units)	8.1	8.3	8.4	8.4
Alkalinity (mg/l)	124	133	136	138
Total P (mg/l)	0.015	0.026	0.018	0.059
Dissolved P (mg/l)	0.010	0.015	0.012	0.023
NO_2 + NO_3 (,g/l)	0.060	0.120	0.070	0.210
Ammonia (mg/l)	0.040	0.063	0.050	0.090
		ALL VALUES		
Secchi disc (inches)	56	65	63	75

B. Biological characteristics:

1. Phytoplankton* -

Sampling Date	Dominant Genera	Number per ml
09/18/72	1. Synedra	2,296
	2. Cyclotella	2,043
	3. Stepanodiscus	416
	4. Fragilaria	380
	5. Dinobryon	163
	Other genera	651
	Total	5,949
11/13/72	1. Melosira	642
	2. Fragilaria	291
	3. Dinobryon	181
	4. Flagellates	161
	5. Cyclotella	141
	Other genera	592
	Total	2,008

* The June sample was lost in shipment.

2. Chlorophyll a -
(Because of instrumentation problems during the 1972 sampling, the following values may be in error by plus or minus 20 percent.)

Sampling Date	Station Number	Chlorophyll a (µg/l)
06/14/72	01	3.2
	02	3.6
	03	8.1
09/18/72	01	26.8
	02	17.5
	03	1.5
11/13/72	01	6.2
	02	4.8
	03	1.5

C. Limiting Nutrient Study:

A 41% loss of dissolved phosphorus occurred in the algal assay sample between the time of collection and the beginning of the assay, and the results are not indicative of lake conditions at the time the sample was taken.

The lake data indicate nitrogen limitation at all sampling times (i.e., N/P ratios were 12/1 or less, and nitrogen limitation would be expected).

IV. NUTRIENT LOADINGS
(See Appendix D for data)

For the determination of nutrient loadings, the Michigan National Guard collected monthly near-surface grab samples from each of the tributary sites indicated on the map (page v), except for high runoff months when two samples were collected. Sampling was begun in October, 1972, and was completed in September, 1973.

Through an interagency agreement, stream flow estimates for the year of sampling and a "normalized" or average year were provided by the Michigan District Office of the U.S. Geological Survey for the tributary sites nearest the lake.

In this report, nutrient loads for sampled tributaries were determined by using a modification of a U.S. Geological Survey computer program for calculating stream loadings*. Nutrient loadings for "minor tributaries and immediate drainage" ("ZZ" of U.S.G.S.) were estimated by using the mean concentrations in Ryan Creek at station C-1 and the mean ZZ flow.

The operators of the Big Rapids, Evart, and Reed City wastewater treatment plants provided monthly effluent samples and corresponding flow data. In the following loading tables, the nutrient loads attributed to the Muskegon River are those measured at station A-2 minus the upstream STP loads (including loads estimated for Village of Hersey septic tanks).

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* See Working Paper No. 1.

A. Waste Sources:

1. Known municipal† -

Name	Pop. Served*	Treatment	Mean Flow (mgd)	Receiving Water
Big Rapids	11,995	prim. clarifier (+ P removal)**	1.100	Muskegon River
Evart	1,707	prim. clarifier + P removal	0.504	Muskegon River
Reed City	2,286	aer. pond + P-removal	0.303	Hersey River

2. Industrial - Unknown

† Wetzel, 1973.
* 1970 Census.
** The calculated effluent phosphorus load of 0.7 lbs/capita/yr indicates phosphorus removal at Big Rapids.

B. Annual Total Phosphorus Loading - Average Year:

1. Inputs -

Source	lbs P/ yr	% of total
a. Tributaries (non-point load) -		
Muskegon River	96,150	82.3
b. Minor tributaries & immediate drainage (non-point load) -	1,570	1.3
c. Known municipal STP's -		
Big Rapids	7,870	6.7
Evart	6,500	5.6
Reed City	4,500	3.9
d. Septic tanks* -	110	0.1
e. Industrial - Unknown	?	-
f. Direct precipitation** -	80	<0.1
Total	116,780	100.0

2. Outputs -

Lake outlet - Muskegon River 100,640

3. Net annual P accumulation - 16,140 pounds

* Estimated 425 persons in Village of Hersey; see Working Paper No. 1.
** See Working Paper No. 1.

C. Annual Total Nitrogen Loading - Average Year:

1. Inputs -

Source	lbs N/yr	% of total
a. Tributaries (non-point load) -		
Muskegon River	2,630,970	93.7
b. Minor tributaries & immediate drainage (non-point load) -	52,610	1.9
c. Known municipal STP's -		
Big Rapids	83,860	3.0
Evart	18,320	0.7
Reed City	14,140	0.5
d. Septic tanks* -	4,000	0.1
e. Industrial - Unknown	?	-
f. Direct precipitation** -	4,920	0.2
Total	2,808,820	100.0

2. Outputs -

Lake outlet - Muskegon River 2,595,070

3. Net annual N accumulation - 213,750 pounds

* Estimated 425 persons in Village of Hersey; see Working Paper No. 1.
** See Working Paper No. 1.

D. Mean Annual Non-point Nutrient Export by Subdrainage Area:

Tributary	lbs P/mi^2/yr	lbs N/mi^2/yr	N/P Ratio
Muskegon River	53	1,446	27/1

E. Yearly Loading Rates:

In the following table, the existing phosphorus loading rates are compared to those proposed by Vollenweider (in press). Essentially, his "dangerous" rate is the rate at which the receiving water would become eutrophic or remain eutrophic; his "permissible" rate is that which would result in the receiving water remaining oligotrophic or becoming oligotrophic if morphometry permitted. A mesotrophic rate would be considered one between "dangerous" and "permissible".

Note that Vollenweider's model may not be applicable to water bodies with very short hydraulic retention times.

Units	Total Phosphorus		Total Nitrogen	
	Total	Accumulated	Total	Accumulated
lbs/acre/yr	228.5	31.6	5,496.7	418.3
grams/m^2/yr	25.61	3.54	616.1	46.9

Vollenweider loading rates for phosphorus (g/m^2/yr) based on surface area and mean outflow of Rogers Pond:

"Dangerous" (eutrophic rate)	4.60
"Permissible" (oligotrophic rate)	2.30

V. LITERATURE REVIEWED

Fetterolf, Carlos, 1973. Personal communication (area of Rogers Pond). MI Dept. Nat. Resources, Lansing.

Massey, Albert, 1975. Personal communication (review of preliminary report on Rogers Pond; phosphorus removal at Big Rapids). MI Dept. Nat. Resources, Lansing.

Vollenweider, Richard A. (in press). Input-output models. Schweiz. Z. Hydrol.

Wetzel, Michael, 1973. Treatment plant questionnaires (Big Rapids, Evart, and Reed City STP's). MI Dept. Nat. Resources, Lansing.

VI. APPENDICES

APPENDIX A

LAKE RANKINGS

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	FALL VALUES: MEAN TOTAL P	FALL VALUES: MEAN DISS P	FALL VALUES: MEAN INORG N	ALL VALUES: 500-MEAN SEC	ALL VALUES: MEAN CHLORA	ALL VALUES: 15-MIN UO
2640	HOLLOWAY RESERVOIR	0.062	0.043	1.461	439.375	10.678	9.200
2641	CARO RESERVOIR	0.117	0.022	3.835	473.000	11.967	9.500
2642	BOARDMAN HYDRO POND	0.006	0.005	0.358	363.500	1.267	6.600
2643	ALLEGAN LAKE	0.123	0.057	1.168	478.222	20.311	12.600
2646	BARTON LAKE	0.121	0.006	1.489	456.167	27.800	14.050
2649	BELLEVILLE LAKE	0.118	0.048	1.420	469.250	28.262	8.200
2610	BETSIE LAKE	0.025	0.006	0.273	481.667	4.567	7.400
2613	BRIGHTON LAKE	0.109	0.073	1.015	456.800	44.233	7.500
2617	LAKE CHARLEVOIX	0.007	0.006	0.230	351.250	3.008	9.240
2618	LAKE CHEMUNG	0.044	0.014	0.132	484.333	13.483	14.800
2621	CONSTANTINE RESERVOIR	0.027	0.008	0.910	456.167	39.317	7.500
2629	FORD LAKE	0.185	0.058	1.536	456.167	14.733	14.000
2631	FREMONT LAKE	0.372	0.342	1.406	441.667	28.500	14.800
2640	JORDAN LAKE	0.180	0.144	1.998	427.667	28.517	14.900
2643	KENT LAKE	0.040	0.015	0.417	455.800	33.944	13.800
2648	LAKE MACATAWA	0.197	0.120	2.358	477.600	25.600	12.200
2649	MANISTEE LAKE	0.018	0.010	0.304	451.333	6.317	11.360
2659	MUSKEGON LAKE	0.007	0.003	0.469	436.444	9.511	14.900
2665	PENTWATER LAKE	0.027	0.017	0.496	430.667	16.083	14.800
2671	RANDALL LAKE	0.246	0.183	0.816	497.333	27.217	8.020
2672	ROGERS POND	0.026	0.015	0.183	435.500	8.133	9.600
2673	RUSS RESERVOIR	0.034	0.021	0.460	469.333	10.383	8.200
2674	SANFORD LAKE	0.016	0.008	0.387	458.750	13.791	8.300
2683	THORNAPPLE LAKE	0.042	0.032	1.737	442.833	14.650	10.800
2685	UNION LAKE	0.081	0.064	1.252	455.500	15.467	8.200
2688	WHITE LAKE	0.027	0.019	0.367	417.778	9.211	13.400
2691	MONA LAKE	0.387	0.241	0.963	451.667	27.783	14.100
2692	LONG LAKE	0.163	0.148	0.749	418.400	18.867	13.600

LAKE DATA TO BE USED IN RANKINGS

LAKE CODE	LAKE NAME	FALL VALUES: MEAN TOTAL P	FALL VALUES: MEAN DISS P	FALL VALUES: MEAN INORG N	ALL VALUES: 500-MEAN SEC	ALL VALUES: MEAN CHLORA	ALL VALUES: 15-MIN DO
2693	ST LOUIS RESERVOIR	0.134	0.093	1.227	462.667	5.583	8.420
2694	CHYSTAL LAKE	0.009	0.006	0.164	380.000	2.986	13.000
2695	HIGGINS LAKE	0.007	0.005	0.058	268.500	1.043	9.400
2696	HOUGHTON LAKE	0.018	0.008	0.136	420.833	9.217	8.200
2697	THOMPSON LAKE	0.043	0.029	0.436	407.889	11.967	14.800
2698	PERE MARQUETTE LAKE	0.032	0.024	0.346	448.667	11.833	8.600
2699	STRAWBERRY LAKE	0.069	0.050	0.567	419.800	11.117	13.600

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	ALL VALUES: MEAN TOTAL P	ALL VALUES: MEAN DISS P	ALL VALUES: MEAN INORG N	ALL VALUES: SDD-MEAN SEC	ALL VALUES: MEAN CHLORA	ALL VALUES: 1S-MIN OD	INDEX NO
2640	HOLLOWAY RESERVOIR	46 (16)	43 (15)	17 (6)	57 (20)	60 (21)	63 (22)	286
2641	CARO RESERVOIR	29 (10)	54 (19)	0 (0)	3 (1)	49 (17)	54 (19)	189
2642	BOARDMAN HYDRO POND	97 (34)	97 (34)	69 (24)	91 (32)	94 (33)	97 (34)	545
2683	ALLEGAN LAKE	20 (7)	31 (11)	31 (11)	6 (2)	29 (10)	40 (14)	157
2606	BANTON LAKE	23 (8)	20 (7)	14 (5)	29 (9)	14 (5)	3 (1)	103
2609	BELLEVILLE LAKE	26 (9)	37 (13)	20 (7)	11 (4)	11 (4)	74 (26)	184
2610	BETSIE LAKE	77 (27)	77 (27)	80 (28)	17 (6)	86 (30)	94 (33)	431
2613	BRIGHTON LAKE	31 (11)	23 (8)	34 (12)	34 (12)	0 (0)	90 (31)	212
2617	LAKE CHARLEVOIX	91 (32)	91 (32)	83 (29)	94 (33)	89 (31)	60 (21)	508
2618	LAKE CHEMUNG	49 (17)	71 (25)	94 (33)	86 (30)	46 (16)	11 (2)	357
2621	CONSTANTINE RESERVOIR	71 (25)	83 (29)	40 (14)	29 (9)	3 (1)	90 (31)	316
2629	FORD LAKE	34 (12)	29 (10)	11 (4)	29 (9)	37 (13)	23 (8)	163
2631	FREMONT LAKE	0 (0)	0 (0)	23 (8)	54 (19)	9 (3)	11 (2)	97
2640	JORDAN LAKE	11 (4)	11 (4)	6 (2)	69 (24)	26 (9)	0 (0)	123
2643	KENT LAKE	57 (20)	69 (24)	63 (22)	40 (14)	6 (2)	36 (12)	271
2648	LAKE MACATAWA	9 (3)	14 (5)	3 (1)	0 (0)	23 (8)	43 (15)	92
2649	MANISTEE LAKE	80 (28)	74 (26)	77 (27)	46 (16)	80 (28)	46 (16)	403
2659	MUSKEGON LAKE	37 (13)	40 (14)	54 (19)	60 (21)	69 (24)	11 (2)	271
2665	PENTWATER LAKE	69 (24)	63 (22)	51 (18)	66 (23)	31 (11)	11 (2)	291
2671	RANDALL LAKE	6 (2)	6 (2)	43 (15)	23 (8)	20 (7)	86 (30)	184
2672	ROGERS POND	74 (26)	66 (23)	86 (30)	63 (22)	77 (27)	51 (18)	417
2673	ROSS RESERVOIR	60 (21)	57 (20)	57 (20)	9 (3)	63 (22)	74 (26)	325
2674	SANFORD LAKE	86 (30)	80 (28)	74 (26)	20 (7)	43 (15)	71 (25)	374
2683	THORNAPPLE LAKE	54 (19)	46 (16)	9 (3)	51 (18)	40 (14)	49 (17)	249
2685	UNION LAKE	40 (14)	26 (9)	26 (9)	37 (13)	34 (12)	74 (26)	242
2688	WHITE LAKE	66 (23)	60 (21)	66 (23)	80 (28)	74 (26)	31 (11)	377
2691	MONA LAKE	3 (1)	3 (1)	37 (13)	43 (15)	17 (6)	20 (7)	123
2692	LONG LAKE	14 (5)	9 (3)	46 (16)	77 (27)	66 (23)	27 (9)	239

PERCENT OF LAKES WITH HIGHER VALUES (NUMBER OF LAKES WITH HIGHER VALUES)

LAKE CODE	LAKE NAME	FALL VALUES: MEAN TOTAL P	FALL VALUES: MEAN DISS P	FALL VALUES: MEAN INORG N	ALL VALUES: 500- MEAN SEC	ALL VALUES: MEAN CHLORA	ALL VALUES: 15- MIN DO	INDEX NO
2693	ST LOUIS RESERVOIR	17 (6)	17 (6)	29 (10)	14 (5)	83 (29)	69 (24)	229
2694	CRYSTAL LAKE	89 (31)	89 (31)	89 (31)	89 (31)	91 (32)	36 (12)	483
2695	HIGGINS LAKE	94 (33)	94 (33)	97 (34)	97 (34)	97 (34)	57 (20)	536
2696	HOUGHTON LAKE	83 (29)	86 (30)	91 (32)	71 (25)	71 (25)	79 (26)	481
2697	THOMPSON LAKE	51 (18)	49 (17)	60 (21)	83 (29)	51 (18)	11 (2)	305
2698	PERE MARQUETTE LAKE	63 (22)	51 (18)	71 (25)	49 (17)	54 (19)	66 (23)	354
2699	STRAWBERRY LAKE	43 (15)	34 (12)	49 (17)	74 (26)	57 (20)	27 (9)	284

APPENDIX B

TRIBUTARY FLOW DATA

TRIBUTARY FLOW INFORMATION FOR MICHIGAN 2/3/75

LAKE CODE 2672 ROGERS POND

TOTAL DRAINAGE AREA OF LAKE(SQ MI) 1855.00

TRIBUTARY	SUB-DRAINAGE AREA(SQ MI)	NORMALIZED FLOWS(CFS) JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	MEAN
2672A1	1855.00	1260.00	1330.00	2110.00	2670.00	1840.00	1380.00	978.00	793.00	840.00	1010.00	1270.00	1260.00	1394.03
2672A2	1820.00	1230.00	1310.00	2070.00	2620.00	1800.00	1350.00	959.00	777.00	824.00	990.00	1240.00	1230.00	1365.58
2672ZZ	35.00	30.00	20.00	40.00	50.00	40.00	30.00	19.00	16.00	16.00	20.00	30.00	30.00	28.45

SUMMARY

TOTAL DRAINAGE AREA OF LAKE = 1855.00
SUM OF SUB-DRAINAGE AREAS = 1855.00

TOTAL FLOW IN = 16741.00
TOTAL FLOW OUT = 16741.00

MEAN MONTHLY FLOWS AND DAILY FLOWS(CFS)

TRIBUTARY	MONTH	YEAR	MEAN FLOW	DAY	FLOW	DAY	FLOW	DAY	FLOW
2672A1	10	72	1254.00	28	2022.00				
	11	72	1610.00						
	12	72	1233.00	4	1155.00	6	1094.00		
	1	73	2668.00	7	2040.00				
	2	73	1933.00	2	2810.00	27	1480.00		
	3	73	4030.00	20	4630.00				
	4	73	2360.00	12	2470.00				
	5	73	2000.00	4	2080.00				
	6	73	1480.00	7	2180.00	21	999.00		
	7	73	968.00	5	1230.00	19	815.00		
	8	73	950.00	27	804.00				
	9	73	827.00	21	827.00				
2672A2	10	72	1229.00	28	1982.00				
	11	72	1578.00						
	12	72	1209.00	4	1132.00	6	1073.00		
	1	73	2616.00	7	2000.00				
	2	73	1895.00	2	2750.00	27	1450.00		
	3	73	3950.00	20	4540.00				
	4	73	2330.00	12	2420.00				
	5	73	1960.00	4	2040.00				
	6	73	1450.00	7	2140.00	21	979.00		
	7	73	949.00	5	1200.00	19	799.00		
	8	73	931.00	27	788.00				
	9	73	811.00	21	811.00				
2672ZZ	10	72	25.00						
	11	72	32.00						
	12	72	24.00						
	1	73	52.00						
	2	73	38.00						
	3	73	80.00						
	4	73	50.00						
	5	73	40.00						
	6	73	30.00						
	7	73	19.00						
	8	73	19.00						
	9	73	16.00						

APPENDIX C

PHYSICAL and CHEMICAL DATA

STORET RETRIEVAL DATE 75/02/04

26/201
43 37 00.0 085 29 00.0
ROGERS POND
26 MICHIGAN

11EPALES 2111202
5 0030 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/14	10	30 0000	19.4	8.0		320	8.20	163	0.040	0.040	0.064	0.032
	10	30 0015	16.0	6.6		380	8.03	163	0.060	0.100	0.036	0.022
72/09/18	09	20 0000			60	340	9.00	154	0.030	0.050	0.020	0.012
	09	20 0004	19.6	10.7		341	8.95	151	0.030	0.070	0.053	0.015
	09	20 0015	18.6	8.3		360	8.65	155	0.050	0.080	0.037	0.018
	09	20 0020	17.3	8.2		360	8.23	154	0.050	0.090	0.044	0.019
	09	20 0028	16.3	5.4		360	8.65	153	0.100	0.320	0.077	0.025
72/11/13	14	50 0000			70	360	8.40	136	0.070	0.050	0.017	0.011
	14	50 0004	8.5	10.0		335	8.40	138	0.070	0.040	0.015	0.011
	14	50 0015	8.5	10.0		350	8.40	137	0.070	0.040	0.016	0.012
	14	50 0025	8.5									
	14	50 0035	8.5									
	14	50 0045	8.5	10.0		350	8.40	137	0.060	0.040	0.018	0.012
	14	50 0055	8.5									
	14	50 0065	8.5									
	14	50 0075	8.5									
	14	50 0080	8.5	10.0		360	8.40	135	0.100	0.090	0.059	0.016

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/14	10	30 0000	3.2J
72/09/18	09	20 0000	26.8J
72/11/13	14	50 0000	6.2J

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 75/02/04

267202
43 37 00.0 085 28 30.0
ROGERS POND
26 MICHIGAN

11EPALES
5

2111202
0015 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/14	11 00	0000	19.6	8.8	72	370	8.30					
	11 00	0010	16.5	7.8		380	8.12	156	0.040	0.030	0.032	0.020
72/09/18	10 00	0000			56	355	8.95	154	0.030	0.060	0.018	0.012
	10 00	0004	19.6	10.2		340	8.93	155	0.030	0.060	0.028	0.014
72/11/13	15 15	0000			75	365	8.40	138	0.070	0.050	0.018	0.011
	15 15	0004	8.2	10.2		360	8.40	138	0.060	0.040	0.016	0.010
	15 15	0015	8.3	10.2		360	8.40	135	0.060	0.040	0.016	0.011
	15 15	0020	8.3	10.2		360	8.40	136	0.070	0.040	0.016	0.011

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/14	11 00	0000	3.6J
72/09/18	10 00	0000	17.5J
72/11/13	15 15	0000	4.8J

J VALUE KNOWN TO BE IN ERROR

STORET RETRIEVAL DATE 75/02/04

267203
43 38 00.0 085 28 00.0
ROGERS POND
26 MICHIGAN

11EPALES
5

2111202
0010 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00010 WATER TEMP CENT	00300 DO MG/L	00077 TRANSP SECCHI INCHES	00094 CNDUCTVY FIELD MICROMHO	00400 PH SU	00410 T ALK CACO3 MG/L	00630 NO2&NO3 N-TOTAL MG/L	00610 NH3-N TOTAL MG/L	00665 PHOS-TOT MG/L P	00666 PHOS-DIS MG/L P
72/06/14	12 50	0000	19.0	8.6	66	370	8.23	160	0.050	0.020	0.042	0.026
	12 50	0010	18.1	8.0		390	8.25	160	0.060	0.010K	0.032	0.020
72/09/18	10 15	0000			60	345	9.00	155	0.050	0.080	0.027	0.018
	10 15	0004	20.0	8.8		340	8.98	154	0.060	0.080	0.029	0.018
	10 15	0007	19.9	8.7		345	9.00	156	0.060	0.080	0.027	0.020
72/11/13	15 40	0000	6.1	10.2	57	335	8.10	126	0.210	0.090	0.034	0.023
	15 40	0004				328	8.10	124	0.210	0.090	0.033	0.022
	15 40	0015	6.1	10.0		335	8.10	126	0.210	0.090	0.033	0.022
	15 40	0025	6.1	9.8		325	8.10	126	0.210	0.090	0.031	0.023
	15 40	0035	6.0									
	15 40	0042	6.0	9.8		340	8.10	124	0.210	0.090	0.038	0.022

DATE FROM TO	TIME OF DAY	DEPTH FEET	32217 CHLRPHYL A UG/L
72/06/14	12 50	0000	8.1J
72/09/18	10 15	0000	1.3J
72/11/13	15 40	0000	1.5J

K VALUE KNOWN TO BE LESS THAN INDICATED

J VALUE KNOWN TO BE IN ERROR

APPENDIX D

TRIBUTARY and WASTEWATER TREATMENT PLANT DATA

STORET RETRIEVAL DATE 75/02/04

2672A1 LS2672A1
43 36 30.0 085 29 00.0
MUSKEGON RIVER
26 15 BIG RAPIDS
O/ROGERS POND (RSERVOIR)
US 131 BRDG (#802-54011)
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/28	09 45		0.240	0.950	0.069	0.019	0.050
72/12/06	10 15		0.252	0.460	0.060	0.028	0.042
73/01/07	14 15		0.350	1.050	0.063	0.020	0.042
73/02/02	09 05		0.198	0.500	0.054	0.011	0.025
73/02/27	08 10		0.300	0.600	0.095	0.023	0.040
73/04/07	10 00		0.126	0.820	0.200	0.012	0.030
73/04/12	15 00		0.138	0.800	0.039	0.010	0.025
73/05/04	12 45		0.180	0.520	0.048	0.014	0.057
73/06/07	10 51		0.147	0.690	0.046	0.019	0.045
73/06/21	08 05		0.168	0.560	0.039	0.008	0.040
73/07/05	10 50		0.140	0.765	0.027	0.009	0.030
73/07/19	09 45		0.040	1.000	0.033	0.005K	0.030
73/08/27	14 00		0.033	0.320	0.016	0.005K	0.025
73/09/21	10 10		0.079	1.760	0.086	0.010	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

2672A2 LS2672A2
43 39 00.0 085 27 00.0
MUSKEGON RIVER
26 15 BIG RAPIDS
T/ROGERS POND (RESERVOR)
BANK BELO BIG RAPIDS STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/28	09	25	0.208	0.900	0.072	0.014	0.056
73/03/20	08	50	0.120	0.480	0.008	0.008	0.025
73/04/12	15	15	0.132	1.500	0.075	0.011	0.025
73/05/04	13	00	0.180	0.580	0.034	0.014	0.060
73/06/07	12	40	0.154	0.690	0.027	0.020	0.055
73/06/21	08	30	0.189	0.720	0.034	0.011	0.037
73/07/05	10	30	0.130	1.000	0.220	0.009	0.035
73/07/19	10	00	0.054	2.300	0.067	0.013	0.085
73/08/27	13	45	0.052	0.270	0.012	0.005K	0.025
73/09/21	10	25	0.078	0.480	0.040	0.005K	0.025

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

2672A3 LS2672A3
43 42 00.0 085 28 30.0
MUSKEGON RIVER
26 15 BIG RAPIDS
T/ROGERS POND(RESERVOIR)
SI HWY 20 BRDG ABOV BIG RAPIDS STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/28	08 40		0.190	0.850	0.058	0.016	0.052
72/12/06	09 30		0.273	1.440	0.069	0.014	0.028
73/01/07	13 45		0.315		0.270	0.018	0.040
73/02/02	10 15		0.220	1.050	0.062	0.011	0.035
73/03/20	09 20		0.126	1.760	0.048	0.010	0.037
73/04/12	15 35		0.120	0.840	0.014	0.011	0.020
73/05/04	12 50		0.170	0.540	0.017	0.016	0.055
73/06/07	08 30		0.140	0.750	0.016	0.018	0.055
73/06/21	07 30		0.189	0.660	0.015	0.011	0.042
73/07/05	10 00		0.130	1.300	0.097	0.009	0.040
73/07/19	10 00		0.034	0.840	0.021	0.005K	0.030
73/08/27	13 00		0.024	0.260	0.007	0.005K	0.026
73/09/21	10 45		0.058	1.130	0.220	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

2672A4 L52672A4
43 51 00.0 085 26 00.0
MUSKEGON RIVER
26 15 EVART
T/ROGERS POND(RESERVOIR)
CO RD BRDG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/28	11 05		0.150	1.600	0.110	0.015	0.054
72/12/04	20 35		0.210	0.660	0.044	0.020	0.033
73/01/07	15 30		0.240	0.670	0.035	0.020	0.046
73/02/02	08 50		0.176	0.540	0.027	0.012	0.030
73/03/20	09 00		0.077	0.480	0.006	0.009	0.025
73/04/12	10 00		0.098	0.600	0.008	0.007	0.020
73/05/04	15 30		0.120	0.660	0.050	0.014	0.050
73/06/07	08 45		0.100	0.690	0.016	0.016	0.045
73/06/21	09 00		0.176	1.150	0.028	0.014	0.040
73/07/05	08 40		0.120	3.000	0.130	0.011	0.045
73/07/19	11 20		0.015	0.840	0.096	0.005K	0.025
73/08/27	10 50		0.015	0.620	0.013	0.005K	0.020
73/09/21	10 00		0.048	0.250	0.033	0.005K	0.020

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

2672B1 L52672B1
47 51 00.0 085 26 30.0
MERSEY RIVER
26 15 EVART
T/ROGERS POND(RESERVOIR)
CO RD KING HELD REED CITY STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/28	11 30		0.120	1.300	0.105	0.007	0.024
72/12/04	21 00		0.380	1.600	0.129	0.031	0.048
73/01/07	15 15		0.350	1.680	0.100	0.076	0.105
73/02/02	09 10		0.400	0.710	0.130	0.040	0.120
73/02/27	08 30		0.340	0.400	0.112	0.073	0.110
73/03/20	09 10		0.210	0.600	0.120	0.031	0.050
73/04/12	10 50		0.230	1.100	0.270	0.030	0.055
73/05/04	15 40		0.170	1.800	0.105	0.061	0.090
73/06/07	08 50		0.210	0.720	0.060	0.037	0.075
73/06/21	09 05		0.260	0.670	0.105	0.094	0.135
	09 15		0.154	0.420	0.067	0.012	0.025
73/07/05	08 45		0.310	1.100	0.260	0.032	0.065
73/07/19	11 30		0.198	1.380	0.099	0.029	0.060
73/08/27	11 00		0.147	0.260	0.044	0.026	0.070
73/09/21	10 30		0.240	0.330	0.066	0.036	0.065

STORET RETRIEVAL DATE 75/02/04

2672B2 LS2672B2
43 53 00.0 085 31 00.0
MERSEY RIVER
26 15 REED CITY
T/ROGERS POND(RESERVOIR)
US 10 BRDG ABOV REED CITY STP
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/28	11 10		0.250	0.550	0.099	0.024	0.054
72/12/04	21 30		0.240	0.390	0.126	0.018	0.022
73/01/07	14 45		0.260	0.960	0.086	0.010	0.024
73/02/02	09 30		0.294	1.380	0.088	0.015	0.040
73/03/20	09 20		0.140	0.460	0.035	0.012	0.020
73/04/12	11 00		0.126	0.580	0.056	0.006	0.025
73/05/04	15 50		0.091	0.560	0.031	0.009	0.025
73/06/07	09 05		0.110	0.400	0.050	0.013	0.032
73/07/05	08 55		0.160	0.440	0.078	0.011	0.025
73/07/19	11 40		0.147	1.400	0.110	0.010	0.040
73/08/27	11 10		0.082	0.520	0.016	0.005K	0.025
73/09/21	10 15		0.132	0.750	0.138	0.008	0.030

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

2672C1 LS2672C1
43 41 00.0 085 27 30.0
RYAN CREEK
26 15 BIG RAPIDS
T/ROGERS POND(RESERVOIR)
MILLPOND RD BRDG
11EPALES 2111204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P
72/10/28	08 55		0.078	0.750	0.092	0.005K	0.026
72/12/06	09 45		0.147	0.660	0.029	0.007	0.012
73/01/07	13 30		0.190	1.400	0.066	0.008	0.023
73/02/02	10 20		0.200	0.600	0.050	0.008	0.025
73/03/20	09 30		0.130	0.460	0.010	0.007	0.015
73/04/12	15 45		0.065	0.700	0.009	0.005K	0.030
73/05/04	13 00		0.037	0.500	0.016	0.006	0.025
73/06/07	12 15		0.028	0.600	0.015	0.013	0.040
73/06/21	09 00		0.069	0.750	0.037	0.010	0.040
73/07/05	10 10		0.054	1.600	0.063	0.011	0.045
73/07/19	10 30		0.075	1.890	0.067	0.010	0.030
73/08/27	11 30		0.120	0.440	0.038	0.008	0.030
73/09/21	10 55		0.132	0.560	0.058	0.009	0.025

K VALUE KNOWN TO BE
LESS THAN INDICATED

STORET RETRIEVAL DATE 75/02/04

267250 PR267250 P011995
43 41 30.0 085 28 00.0
BIG RAPIDS
26 15 BIG RAPIDS
T/ROGERS POND
MUSKEGON RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
74/05/09	00 00								
CP(T)-			0.240	21.000	1.300	0.140	1.500	1.100	1.100
74/05/09	24 00								

STORET RETRIEVAL DATE 75/02/04

34<

267250 PR267250 P011995
43 41 30.0 085 28 00.0
BIG RAPIDS
26 15 BIG RAPIDS
T/ROGERS POND
MUSKEGON RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/02/28 00 00									
CP(T)-									
73/02/28 24 00			0.240	30.000	16.800	0.125	1.190	1.500	1.300
73/03/08 00 00									
CP(T)-									
73/03/08 24 00			0.345	26.000	12.400	0.120	2.200	1.700	1.400
73/04/24 00 00									
CP(T)-									
73/04/24 24 00			0.165	30.000	13.60C	0.320	2.800	1.500	1.300
73/05/07 00 00									
CP(T)-									
73/05/07 24 00			0.185	27.300	13.500	0.130	1.600	1.500	1.300
73/06/24 00 00									
CP(T)-									
73/06/24 24 00			0.204	15.700	8.650	0.072	0.530	0.750	1.000
73/09/23 00 00									
CP(T)-									
73/09/23 24 00			0.030	28.000	15.000	1.260	3.800	0.970	1.100
73/10/07 00 00									
CP(T)-									
73 10/07 24 00			0.050	26.000	15.800	0.430	1.650	0.950	1.100
73/12/13 08 00									
CP(T)-									
73/12/14 08 00			7.250	10.500	0.125	2.850	6.300	0.347	0.300
74/01/09 00 00									
CP(T)-									
74/01/09 24 00			0.360	26.000	10.600	0.430	2.500	1.100	1.000
74/02/05 00 00									
CP(T)-									
74/02/05 24 00								1.500	1.200
74/03/14 00 00									
CP(T)-									
74/03/14 24 00			0.040	22.000	0.160	0.050K	5.825	1.200	1.200
74/04/16 00 00									
CP(T)-									
74/04/16 24 00			0.760	16.000	5.300	0.120	0.900	1.200	1.100

STORET RETRIEVAL DATE 75/02/04

26/251 PJ267251 P001645
43 53 30.0 085 15 30.0
EVART
26 15 EVART
1/ROGERS POND
MUSKEGON RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/01/29	07 00								
CP(T)-			0.550	8.800	0.057	1.890	2.450	0.600	0.550
73/01/30	07 00								
73/02/07	07 00		0.370	11.500	0.180	4.700	8.800	0.580	0.500
73/03/18	00 00								
CP(T)-			0.575	9.400	0.115	1.260	3.000	0.700	0.500
73/03/19	00 00								
73/04/22			0.345	8.900	0.078	2.200	3.900	0.570	0.610
73/05/15			0.591	11.000	0.065	1.470	3.000	0.560	0.580
73/06/11			0.027	11.500	0.220	5.300	7.750	0.510	0.560
73/07/09	25 00								
CP(T)-			0.070	11.500	0.210	1.200	2.800	0.500	0.500
73/07/10									
73/08/13	12 00								
CP(T)-			0.140	5.600	0.300	0.580	1.400	0.430	0.500
73/08/14	12 00								
73/09/11			0.139	13.200	0.330	4.200	5.900	0.380	0.370
73/10/09	07 00								
CP(T)-			0.780	13.500	0.200	1.600	2.500	0.360	0.500
73/10/10	07 00								
73/11/06	07 00								
CP(T)-			0.600	21.000	1.400	3.150	5.200	0.340	0.500
73/11/07	07 00								
73/12/08	07 00		0.580	19.000	0.940	2.700	4.100	0.390	0.380

STORET RETRIEVAL DATE 75/02/04

36<

267252 P0267252 P002050
43 52 30.0 085 35 00.0
REED CITY
26 15 REED CITY
T/ROGERS POND
JEWITT RIVER
11EPALES 2141204
4 0000 FEET DEPTH

DATE FROM TO	TIME OF DAY	DEPTH FEET	00630 NO2&NO3 N-TOTAL MG/L	00625 TOT KJEL N MG/L	00610 NH3-N TOTAL MG/L	00671 PHOS-DIS ORTHO MG/L P	00665 PHOS-TOT MG/L P	50051 FLOW RATE INST MGD	50053 CONDUIT FLOW-MGD MONTHLY
73/02/12	08 00								
CP(T)-			0.880	16.000	3.500	4.800	5.400	0.318	0.300
73/02/13	08 00								
73/03/22	08 00								
CP(T)-			0.610	17.000	5.700	4.400	4.500	0.335	0.300
73/03/23	20 00								
73/04/24	07 30								
CP(T)-			0.860	17.600	4.200	5.200	5.900	0.386	0.370
73/04/25	07 30								
73/05/20	08 00								
CP(T)-			7.600	9.400	0.850	3.500	3.780	0.448	0.400
73/05/21	08 00								
73/06/28	08 00								
CP(T)-			2.300	9.300	2.200	6.000	7.700	0.310	0.330
73/06/29	08 00								
73/07/24	08 00								
CP(T)-			3.600	10.400	1.260	1.750	3.350	0.312	0.300
73/07/25	08 00								
73/08/27	08 00								
CP(T)-				1.400	0.056	1.140	1.890	0.258	0.275
73/08/28	08 00								
73/09/20	08 00								
CP(T)-			2.100	4.300	0.730	3.280	4.400	0.247	0.260
73/09/21	08 00								
73/10/30	08 00								
CP(T)-			6.300	10.500	3.740	4.400	5.250	0.213	0.260
73/10/31	08 00								
73/11/26	08 00								
CP(T)-			10.000	5.500	0.040K	1.700	3.150	0.257	0.260
73/11/27	08 00								
74/01/29	08 00								
CP(T)-			0.040	15.000	0.150	5.400	6.400	0.324	0.280
74/01/30	08 00								
74/02/11	08 00								
CP(T)-			2.000	12.750	6.600	2.240	4.100	0.295	0.300
74/02/12	20 00								